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I, LEANNE MYNOTT, MANAGER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003903646 for a patent by BUSHWATER HOLDINGS PTY LTD as filed on 16 July 2003.

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PROVISIONAL SPECIFICATION

Applicant:

BUSHWATER HOLDINGS PTY LTD

Invention Title:

WASTE WATER TREATMENT

The invention is described in the following statement:

FIELD OF THE INVENTION

The present invention relates to waste water treatment and, more particularly, to the treatment of waste water which contains soluble phosphorous.

SUMMARY OF THE INVENTION

The present invention provides a process for treating waste water which contains soluble phosphorous, the process including the step of reacting the soluble phosphorous under reaction conditions to form a magnesium ammonium phosphate precipitate.

Preferably, the precipitate is a complex known as struvite which has an assumed formula of $MgNH_4PO_4 \cdot 6H_2O$ although the precipitate may be another magnesium ammonium phosphate complex.

Preferably, magnesium oxide provides a source of magnesium ions for reaction in the process. Preferably, the magnesium oxide is provided in the form of granules. Preferably, the magnesium oxide granules are of a granular size in the order of 5-20 mm, more preferably, 10-20 mm.

Preferably, the process is conducted in a reaction vessel containing a bed of the preferred magnesium oxide granules with the reaction vessel arranged for flow of the waste water through the bed. The waste water may flow through the bed in any direction but preferably flows upwardly through the bed.

Preferably, ammonia provides a source of ammonium ions for reaction in the process. Ammonia may be added as a reactant for the process; however, it is preferred that requisite ammonia is present in the waste water to be treated. Preferably, the waste water contains in excess of 100 ppm ammonia, more preferably in excess of 200 ppm ammonia, and most preferably about 250 ppm ammonia although the process can be satisfactorily conducted at ammonia levels below 100 ppm and above 250 ppm.

The waste water is preferably waste water from the treatment of sewerage. Sewerage waste water typically

contains ammonia at a concentration in the order of 40-50 ppm following a typical secondary treatment of sewerage at large scale sewerage treatment plants. Although such waste water can be treated by the present invention, it is believed that additional ammonia would need to be added to the waste water to enable satisfactory production of the magnesium ammonium phosphate precipitate. The process of the present invention is preferably conducted in a so-called home treatment plant (HTP) downstream of a septic treatment apparatus such as a septic tank. Waste water exiting septic tanks typically contains about 200 mg/L (ppm) ammonia which renders it suitable for treatment by the process of the present invention without addition of ammonia.

Phosphate may be removed from waste water treated in accordance with the present invention as a precipitate other than a magnesium ammonium phosphate precipitate. For example, operation of the process of the present invention may result in the formation of calcium hydroxy phosphate precipitates such as a complex known as hydroxy apatite which has an assumed formula of $Ca_5OH(PO_4)_3$. The formation of such precipitates additional to magnesium ammonium phosphate precipitates falls within the scope of the present invention with the production of such precipitates being dependent upon the specific composition of the waste water to be treated and the reaction conditions under which the process of the present invention is conducted. For example, the likelihood of producing hydroxy apatite will be enhanced where the waste water to be treated is hard, ie. contains a high level of calcium.

Waste water for treatment by the process of the present invention will typically contain in the order of 8-20mg/L of phosphorous. It is preferable that the water following treatment in accordance with the present invention will contain less than 5mg/L of phosphorous.

In one preferred embodiment of the present

invention, a magnesium oxide bed is formed which is about 1200 mm deep, has a volume of about 20 litres, and is filled with magnesium oxide particles of 5-20 mm diameter to produce a magnesium oxide bed having a mass of about 30kg. The bed preferably forms part of a HTP with waste water from a septic tank having a phosphorous content in excess of 10 mg/L arranged to flow downwardly through the bed at a preferred flow rate of about 5-20 litres per minute, more preferably about 10-20 litres per minute. Waste water exiting the bottom of the bed has a phosphorous content less than 5 mg/L and typically has a pH between 8 and 9 although the bed is believed to have regions of higher localised pH (for example pH between 10 and 10.5).

A further preferred embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a top angled view of inner and outer tanks of a waste water circulation apparatus;

Figure 2 is a top schematical view of the outer tank of Figure 1;

Figure 3 is a top schematical view of the inner tank of Figure 1; and

Figure 4 is a schematic representation of an airlift pump.

The magnesium oxide bed is contained in a section of a waste water circulation apparatus which is described in co-pending Australian provisional patent application no. PS 0909 filed 5 March 2002; the contents of which are incorporated herein by reference. The waste water circulation apparatus takes the form of a double tank having an outer tank 11 and an inner tank 12. The outer tank 11 has six chambers arranged as depicted in Figure 2 and the inner tank 12 is arranged to function as a septic tank. Waste water exiting the inner tank 12 flows into a centre pump well 50 where it subsequently overflows into chamber 1 of the outer tank 11. As the waste water flows

down through chamber 1 it is aerated by means of a venturi apparatus 43. The venturi is supplied with air, as well as sludge and water from chamber 3 by means of a pump 80 located in chamber 3. There is a take off to the bottom of chamber 2 from the line between the pump 80 in chamber 3 and the venturi 43 in chamber 1. The waste water flows from the bottom of chamber 1 into the bottom of chamber 2 which contains the magnesium oxide bed. The waste water flows upwardly through the magnesium oxide bed in chamber 2 to overflow into chamber 3 with struvite formed in chamber 2 in accordance with the present invention and consequential reduction in phosphorous content in chamber 2. The waste water then flows from the bottom of chamber 3 to the bottom of chamber 4, for subsequent treatment in chambers 4, 5 and 6. The subsequent treatment may involve aerobic bacterial reaction of ammonia to nitrate, and anoxic removal of nitrate as nitrogen gas by faculitative bacteria.

Additional mixing and aeration may be supplied by airlift pumps 84 and 85 in chambers 5 and 6. Airlift pumps 84 and 85 return some sludge and waste water to the centre pump well 50. Figure 4 shows a typical airlift pump 90. The airlift pump 90 consists of a narrow vertical tube, extending from the top 95 to the bottom 96 of the tank, with an opening 94 at the bottom of the tube 91. The opening 94 allows for the tube 91 to be filled with waste water. Air is supplied to the vertical tube 91 by means of an air supply line 92, which consequently lifts water and sludge as the bubbles of air 93 rise up the tube 91. Sludge and waste water is then pushed along line by the air 93 back to the centre pump well 50.

Variations and modifications may be made in respect of the invention described above and defined in the following statement of claim:

1. A process for treating waste water which contains soluble phosphorous, the process including the step of reacting the soluble phosphorous under reaction conditions to form a magnesium ammonium phosphate precipitate.

Dated this 16th day of July 2003
Bushwater Holdings Pty Ltd
By its Patent Attorneys
GRIFFITH HACK

FIGURE 1

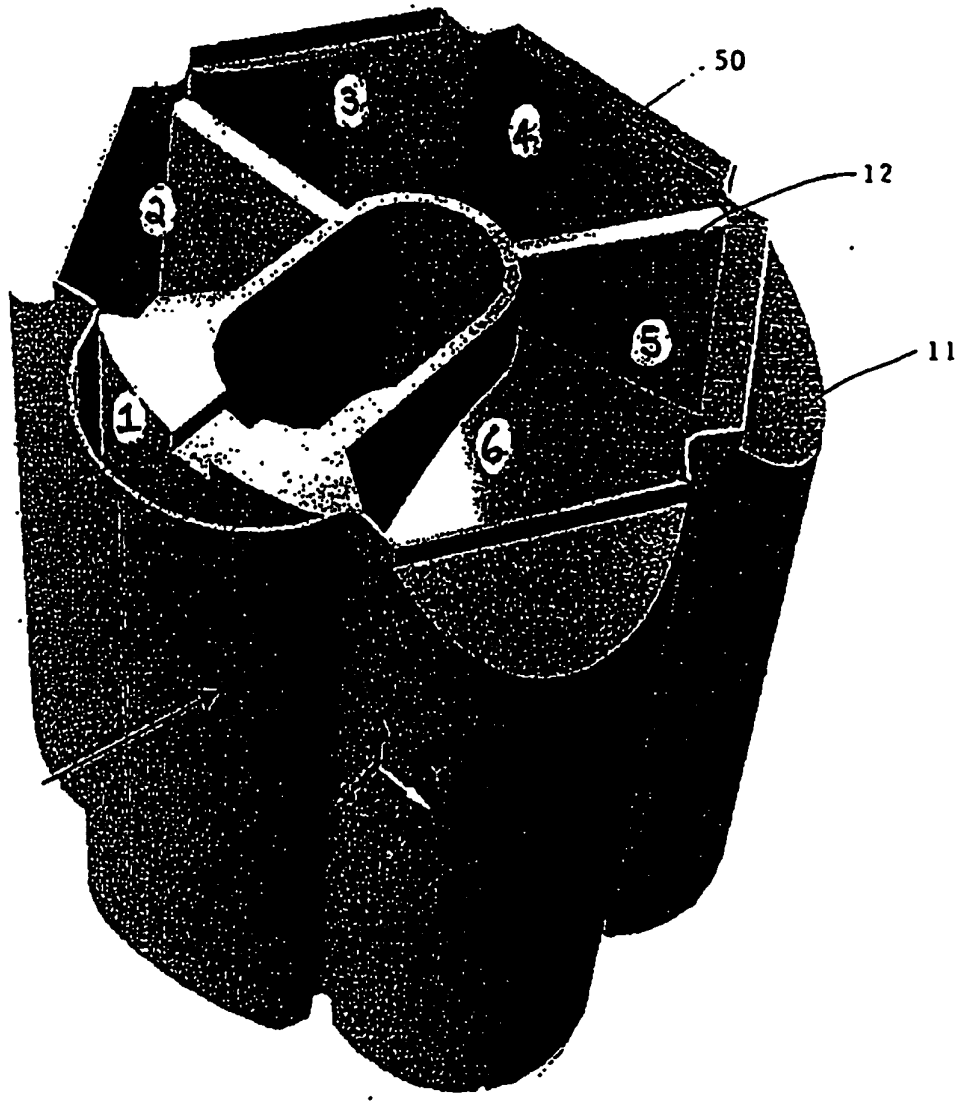


FIGURE 2

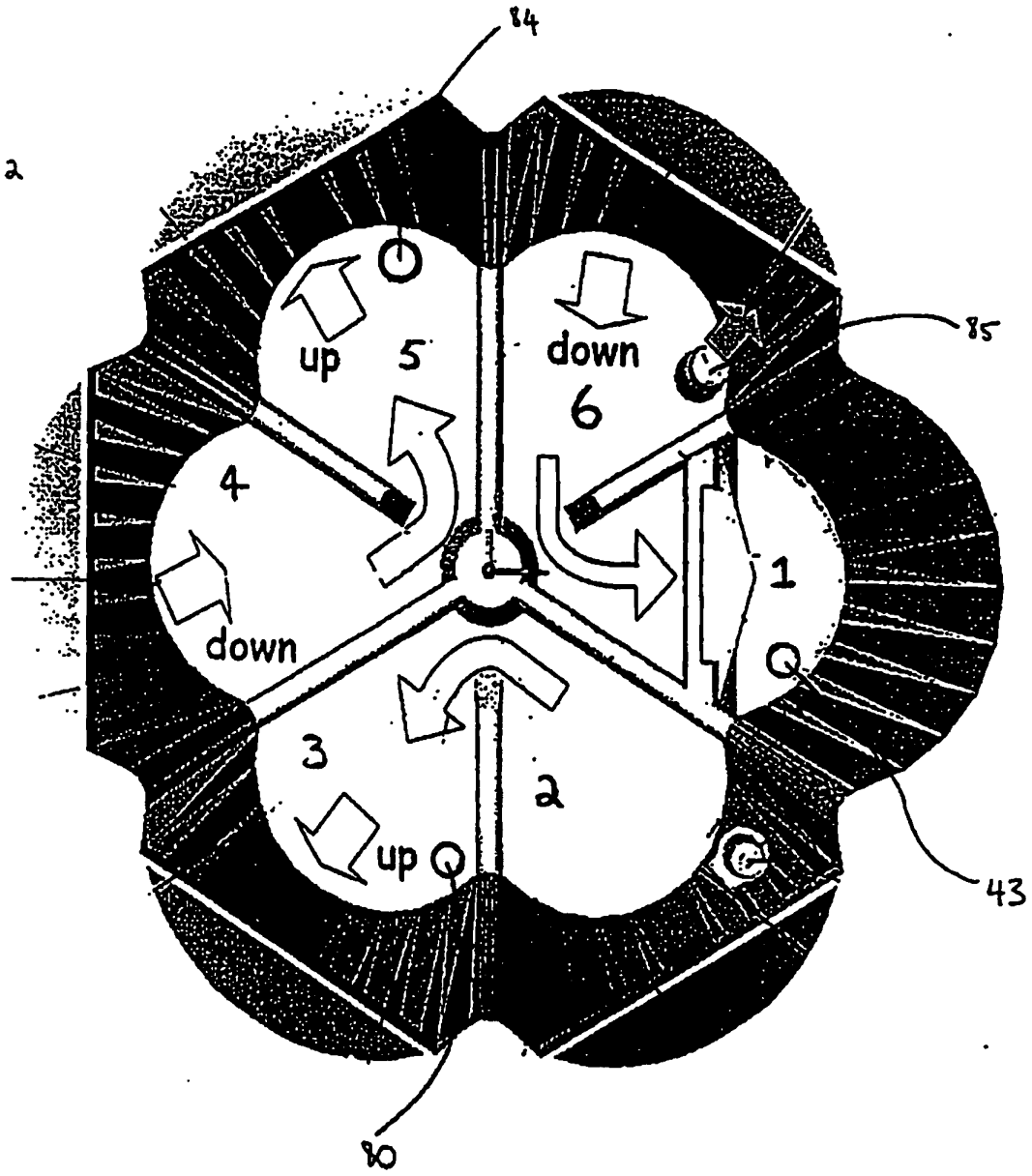
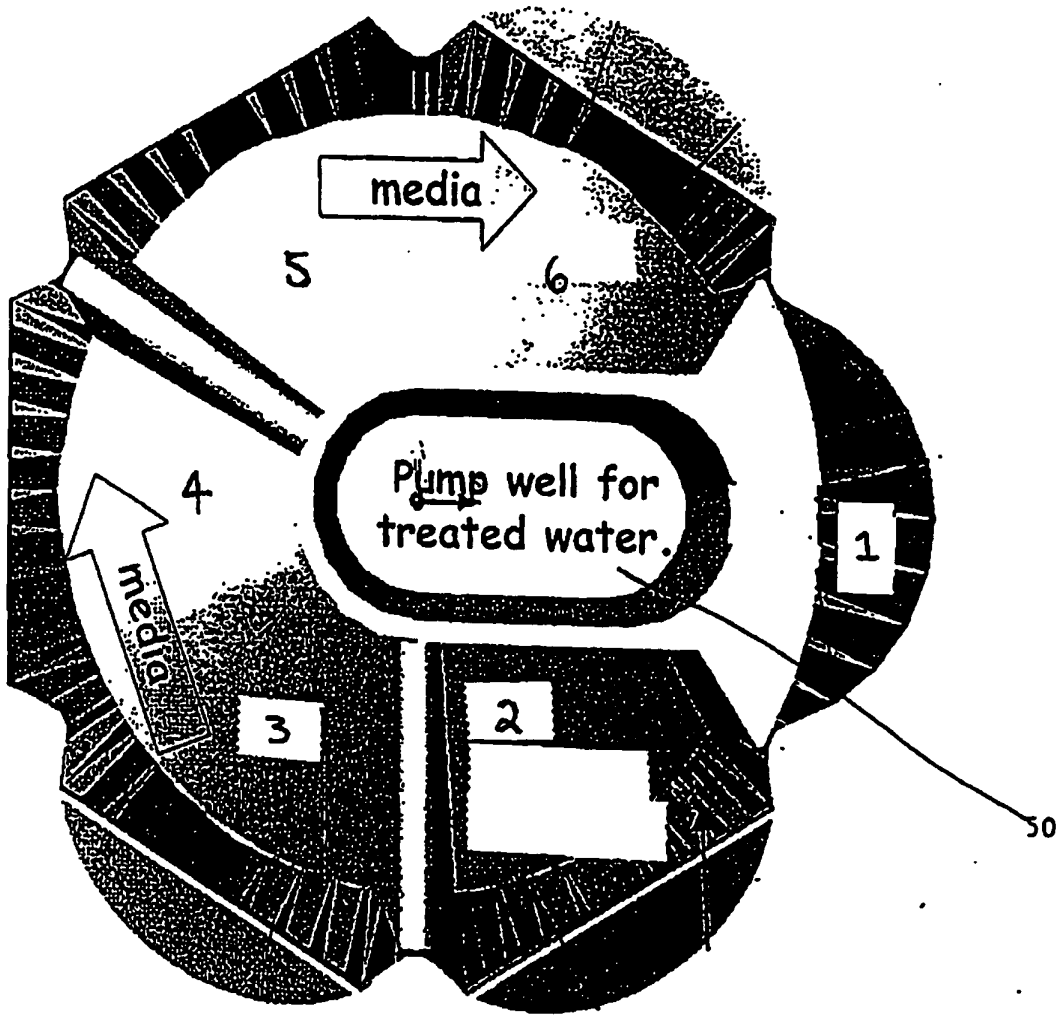


FIGURE 3



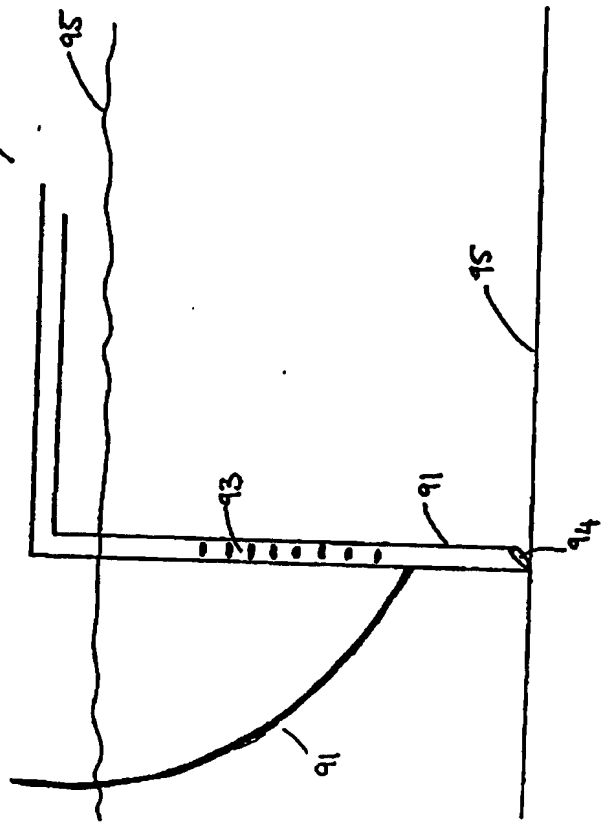


Figure 4

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